

**HIA SURVEY OF THE PORTION 5 OF THE FARM
HARTEBEESTBULT 578 HT**

FOR LOKISA ENVIRONMENTAL CONSULTING CC

DATE: 10 NOVEMBER 2021

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Abbreviations

HP	Historical Period
IIA	Indeterminate Iron Age
LIA	Late Iron Age
EIA	Early Iron Age
ISA	Indeterminate Stone Age
ESA	Early Stone Age
MSA	Middle Stone Age
LSA	Late Stone Age
HIA	Heritage Impact Assessment
PIA	Palaeontological Impact Assessment

EXECUTIVE SUMMARY

The project proposes the sustainable development of the Hartebeestbult farm in Vryheid. The sustainable development includes the reforming of the 220ha farm in order to expand the existing feedstock area, re-establishment of the existing Abattoir, Upgrade of roads, farm fencing, Small Lodge Development and Dams and Water reticulation Upgrade and agricultural Planting Areas for crops and citrus. The site is situated approximately 10km west of Vryheid, 6km north of Scheepersnek Mól (R33 R34) and 3,7km west of the Vryheid Agricultural High School, KwaZulu-Natal Province.

The HIA was undertaken in November 2021. Construction around the main farm house had already commenced, and I had raised concerns that the farmhouse is older than 60 years and no built environment assessment had been undertaken. The buildings were not being altered; however, the stone walled kraal showed recent damage. KZNARI needs to comment on this aspect of the Built Environment.

The survey of the farm did not note any archaeological sites. There was evidence of recent wattle and daub houses near the proposed lodges. More importantly there is a possible grave associated with this settlement. The developer was given options regarding the possible grave and has chosen to demarcate and buffer the graves. Photographic evidence of this will need to be provided. Buffering is a minimum of a fence surrounding the grave at 5m from the edges. There is a no development zone of a minimum of 20m from the grave.

The area will probably only have trace fossils. These are not significant and do not require mitigation. No further palaeontological mitigation is required.

INTRODUCTION

The site is situated approximately 10km west of Vryheid, 6km north of Scheepersnek Môl (R33/R34) and 3,7km west of the Vryheid Agricultural High School, KwaZulu-Natal Province.

The project includes the reforming of the 220ha farm in order to:

- expand the existing feedstock area,
- re-establishment of the existing Abattoir,
- Upgrade of roads, farm fencing,
- Small Lodge Development,
- Dams,
- Water reticulation and upgrade, and
- Agricultural planting areas for crops and citrus.

Umlando was requested to undertake an HIA of the proposed development. Figures 1 – 3 show the location of the development.

FIG. 1 GENERAL LOCATION OF THE PROPOSED DEVELOPMENT

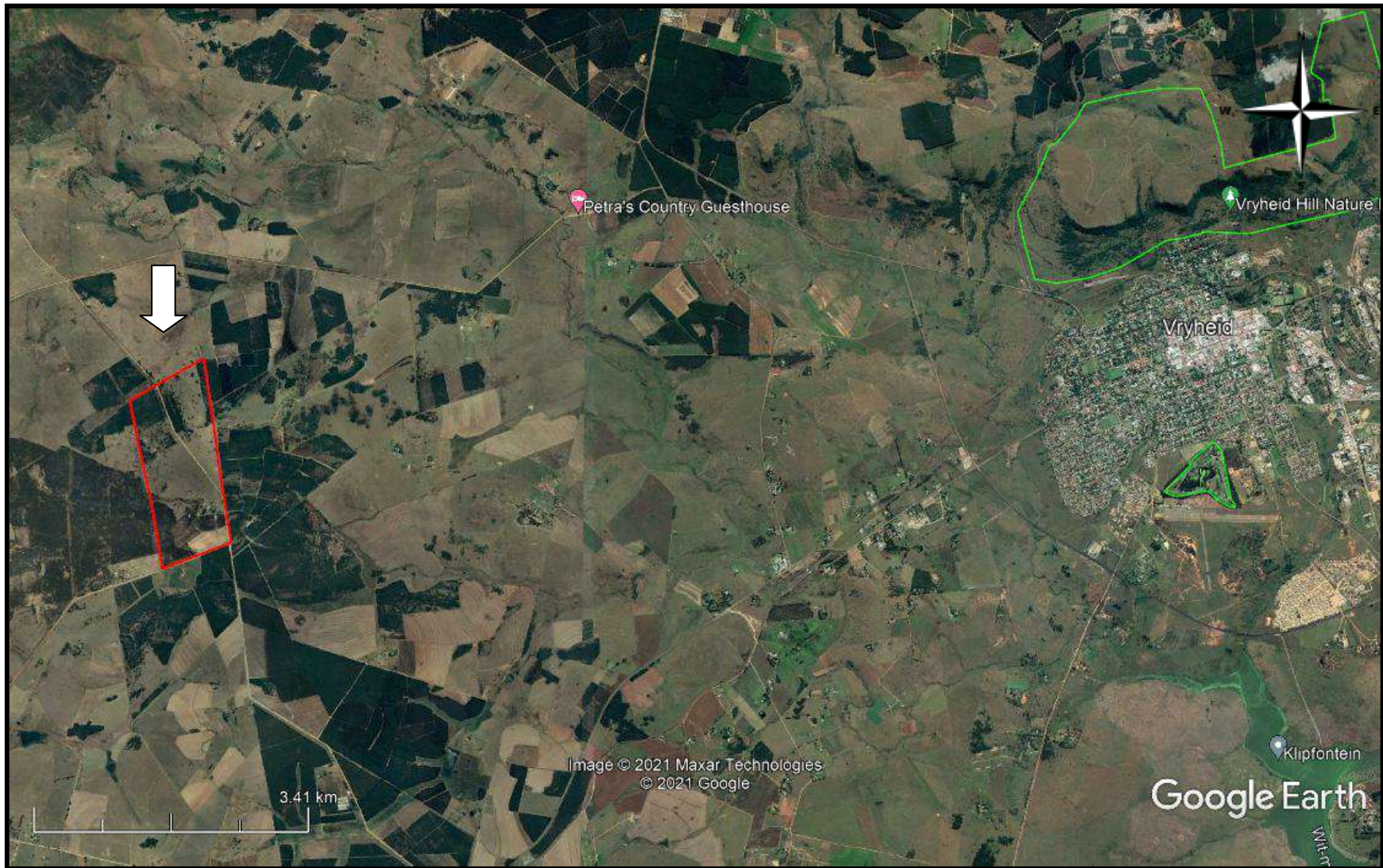


FIG. 2: AERIAL OVERVIEW OF THE PROPOSED DEVELOPMENT



FIG. 3: TOPOGRAPHICAL MAP OF THE PROPOSED DEVELOPMENT (1996)

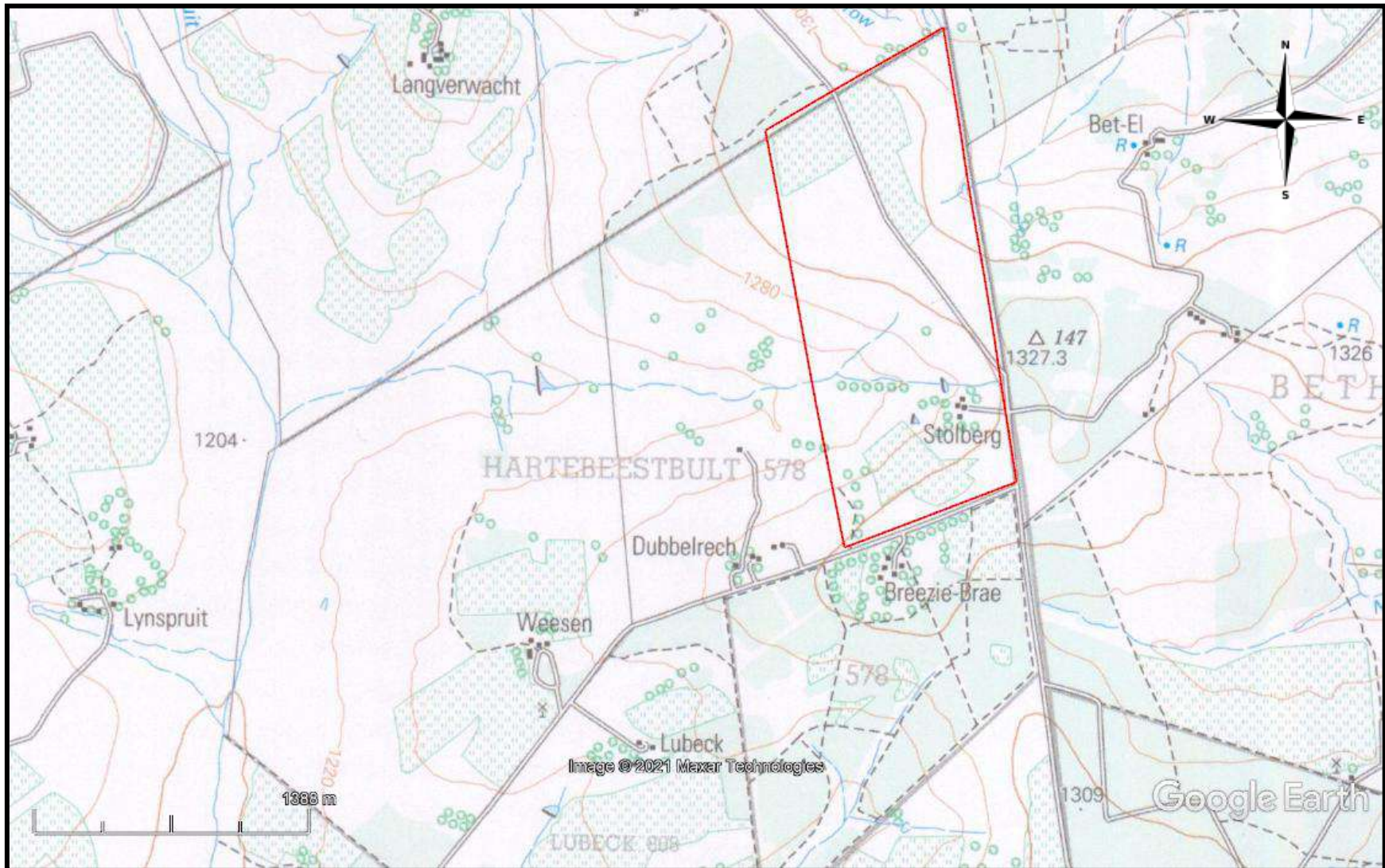


FIG. 4: SCENIC VIEWS OF THE STUDY AREA



KWAZULU NATAL AMAFA AND RESEARCH INSTITUTE, ACT 05, 2018

“General protection: Structures.—

- No structure which is, or which may reasonably be expected to be older than 60 years, may be demolished, altered or added to without the prior written approval of the Council having been obtained on written application to the Council.
- Where the Council does not grant approval, the Council must consider special protection in terms of sections 38, 39, 40, 41 and 43 of Chapter 9.
- The Council may, by notice in the *Gazette*, exempt—
- A defined geographical area; or
- defined categories of sites within a defined geographical area, from the provisions of subsection where the Council is satisfied that heritage resources falling in the defined geographical area or category have been identified and are adequately protected in terms of sections 38, 39, 40, 41 and 43 of Chapter 9.
- A notice referred to in subsection (2) may, by notice in the *Gazette*, be amended or withdrawn by the Council.

General protection: Graves of victims of conflict.—No person may damage, alter, exhume, or remove from its original position—

- the grave of a victim of conflict;
- a cemetery made up of such graves; or
- any part of a cemetery containing such graves, without the prior written approval of the Council having been obtained on written application to the Council.
- General protection: Traditional burial places.—
- No grave—
- not otherwise protected by this Act; and
- not located in a formal cemetery managed or administered by a local authority, may be damaged, altered, exhumed, removed from its original

position, or otherwise disturbed without the prior written approval of the Council having been obtained on written application to the Council.

The Council may only issue written approval once the Council is satisfied that—

- the applicant has made a concerted effort to consult with communities and individuals who by tradition may have an interest in the grave; and
- the applicant and the relevant communities or individuals have reached agreement regarding the grave.

General protection: Battlefield sites, archaeological sites, rock art sites, palaeontological sites, historic fortifications, meteorite or meteorite impact sites.—

- No person may destroy, damage, excavate, alter, write or draw upon, or otherwise disturb any battlefield site, archaeological site, rock art site, palaeontological site, historic fortification, meteorite or meteorite impact site without the prior written approval of the Council having been obtained on written application to the Council.
- Upon discovery of archaeological or palaeontological material or a meteorite by any person, all activity or operations in the general vicinity of such material or meteorite must cease forthwith and a person who made the discovery must submit a written report to the Council without delay.
- The Council may, after consultation with an owner or controlling authority, by way of written notice served on the owner or controlling authority, prohibit any activity considered by the Council to be inappropriate within 50 metres of a rock art site.
- No person may exhume, remove from its original position or otherwise disturb, damage, destroy, own or collect any object or material associated with any battlefield site, archaeological site, rock art site, palaeontological site, historic fortification, meteorite or meteorite impact site without the prior written approval of the Council having been obtained on written application to the Council.
- No person may bring any equipment which assists in the detection of metals and archaeological and palaeontological objects and material, or

- excavation equipment onto any battlefield site, archaeological site, rock art site, palaeontological site, historic fortification, or meteorite impact site, or use similar detection or excavation equipment for the recovery of meteorites, without the prior written approval of the Council having been obtained on written application to the Council.
- The ownership of any object or material associated with any battlefield site, archaeological site, rock art site, palaeontological site, historic fortification, meteorite or meteorite impact site, on discovery, vest in the Provincial Government and the Council is regarded as the custodian on behalf of the Provincial Government.”

METHOD

The method for Heritage assessment consists of several steps.

The first step forms part of the desktop assessment. Here we would consult the database that has been collated by Umlando. This databases contains archaeological site locations and basic information from several provinces (information from Umlando surveys and some colleagues), most of the national and provincial monuments and battlefields in Southern Africa (<http://www.vuvuzela.com/googleearth/monuments.html>) and cemeteries in southern Africa (information supplied by the Genealogical Society of Southern Africa). We use 1st and 2nd edition 1:50 000 topographical and 1937 aerial photographs where available, to assist in general location and dating of buildings and/or graves. The database is in Google Earth format and thus used as a quick reference when undertaking desktop studies. Where required we would consult with a local data recording centre, however these tend to be fragmented between different institutions and areas and thus difficult to access at times. We also consult with an historical architect, palaeontologist, and an historian where necessary.

The survey results will define the significance of each recorded site, as well as a management plan.

All sites are grouped according to low, medium, and high significance for the purpose of this report. Sites of low significance have no diagnostic artefacts or features. Sites of medium significance have diagnostic artefacts or features and these sites tend to be sampled. Sampling includes the collection of artefacts for future analysis. All diagnostic pottery, such as rims, lips, and decorated sherds are sampled, while bone, stone, and shell are mostly noted. Sampling usually occurs on most sites. Sites of high significance are excavated and/or extensively sampled. Those sites that are extensively sampled have high research potential, yet poor preservation of features.

Defining significance

Heritage sites vary according to significance and several different criteria relate to each type of site. However, there are several criteria that allow for a general significance rating of archaeological sites.

These criteria are:

1. State of preservation of:

- 1.1. Organic remains:
 - 1.1.1. Faunal
 - 1.1.2. Botanical
- 1.2. Rock art
- 1.3. Walling
- 1.4. Presence of a cultural deposit
- 1.5. Features:
 - 1.5.1. Ash Features
 - 1.5.2. Graves

- 1.5.3. Middens
- 1.5.4. Cattle byres
- 1.5.5. Bedding and ash complexes

2. Spatial arrangements:

- 2.1. Internal housing arrangements
- 2.2. Intra-site settlement patterns
- 2.3. Inter-site settlement patterns

3. Features of the site:

- 3.1. Are there any unusual, unique or rare artefacts or images at the site?
- 3.2. Is it a type site?
- 3.3. Does the site have a very good example of a specific time period, feature, or artefact?

4. Research:

- 4.1. Providing information on current research projects
- 4.2. Salvaging information for potential future research projects

5. Inter- and intra-site variability

- 5.1. Can this particular site yield information regarding intra-site variability, i.e. spatial relationships between various features and artefacts?
- 5.2. Can this particular site yield information about a community's social relationships within itself, or between other communities?

6. Archaeological Experience:

6.1. The personal experience and expertise of the CRM practitioner should not be ignored. Experience can indicate sites that have potentially significant aspects, but need to be tested prior to any conclusions.

7. Educational:

- 7.1. Does the site have the potential to be used as an educational instrument?
- 7.2. Does the site have the potential to become a tourist attraction?
- 7.3. The educational value of a site can only be fully determined after initial test-pit excavations and/or full excavations.

8. Other Heritage Significance:

- 8.1. Palaeontological sites
- 8.2. Historical buildings
- 8.3. Battlefields and general Anglo-Zulu and Anglo-Boer sites
- 8.4. Graves and/or community cemeteries
- 8.5. Living Heritage Sites
- 8.6. Cultural Landscapes, that includes old trees, hills, mountains, rivers, etc related to cultural or historical experiences.

The more a site can fulfill the above criteria, the more significant it becomes. Test-pit excavations are used to test the full potential of an archaeological deposit. This occurs in Phase 2. These test-pit excavations may require further excavations if the site is of significance (Phase 3). Sites may also be mapped and/or have artefacts sampled as a form of mitigation. Sampling normally occurs when the artefacts may be good examples of their type, but are not in a primary archaeological context. Mapping records the spatial relationship between features and artefacts. Table 1 lists the grading system.

TABLE 1: SAHRA GRADINGS FOR HERITAGE SITES

SITE SIGNIFICANCE	FIELD RATING	GRADE	RECOMMENDED MITIGATION
High Significance	National Significance	Grade 1	Site conservation / Site development
High Significance	Provincial Significance	Grade 2	Site conservation / Site development
High Significance	Local Significance	Grade 3A / 3B	
High / Medium Significance	Generally Protected A		Site conservation or mitigation prior to development / destruction
Medium Significance	Generally Protected B		Site conservation or mitigation / test excavation / systematic sampling / monitoring prior to or during development / destruction
Low Significance	Generally Protected C		On-site sampling monitoring or no archaeological mitigation required prior to or during development / destruction

RESULTS

DESKTOP STUDY

The desktop study consisted of analysing various maps for evidence of prior habitation in the study area, as well as for previous archaeological surveys. Many archaeological sites occur in the general area. The archaeological sites tend to include:

- Stone Age open sites, shelters/overhangs and rock art
- Late Iron Age
- Historical Period
- 2nd Anglo-Boer War battlefields and cemeteries
- Various Christian missions

These sites vary in their significance and most have been recorded through systematic surveys (fig. 5).

The Farm Hartebeestbult 578 was first surveyed in 1894 and then Granted 1895 (fig. 6). Occupation of the farm and related buildings would have occurred shortly thereafter. All buildings on the farm can be assumed to date to 1895 – 1905 at least.

The 1953 topographical map indicates that there are several buildings on the farm. The farm is referred to as Stolberg. (fig. 7). This means that the main farm building and associated barns would predate 1953 and thus be older than 60 years in age. These building are protected by the KZNARI Act and require permits to damage, alter or remove. This would include the gardens and any middens associated with the household.

FIG. 5: LOCATION OF KNOWN HERITAGE SITES IN THE GENERAL AREA

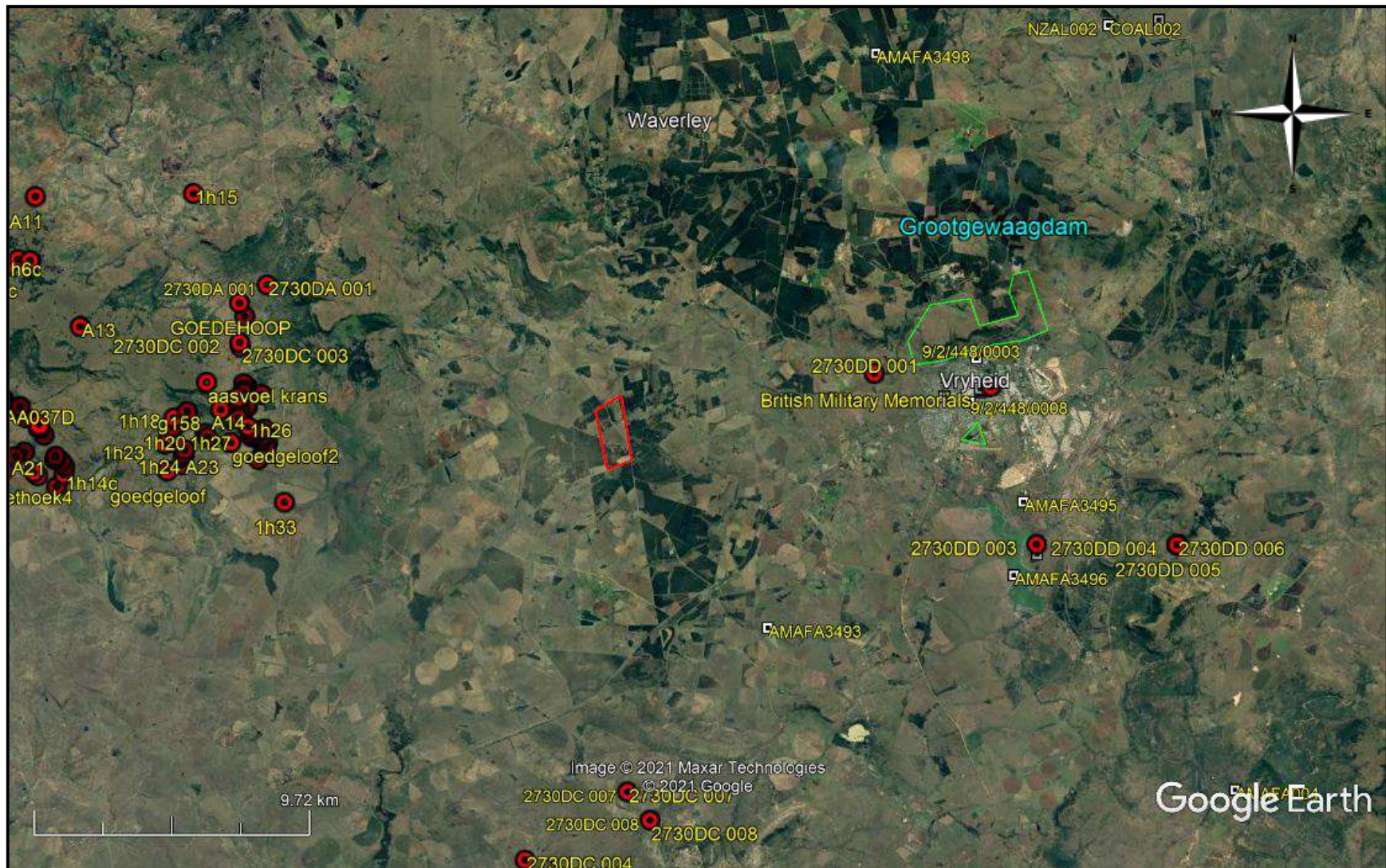


FIG. 6: SURVEYOR GENERAL MAP OF HARTEBEESTBULT 578 (1894)

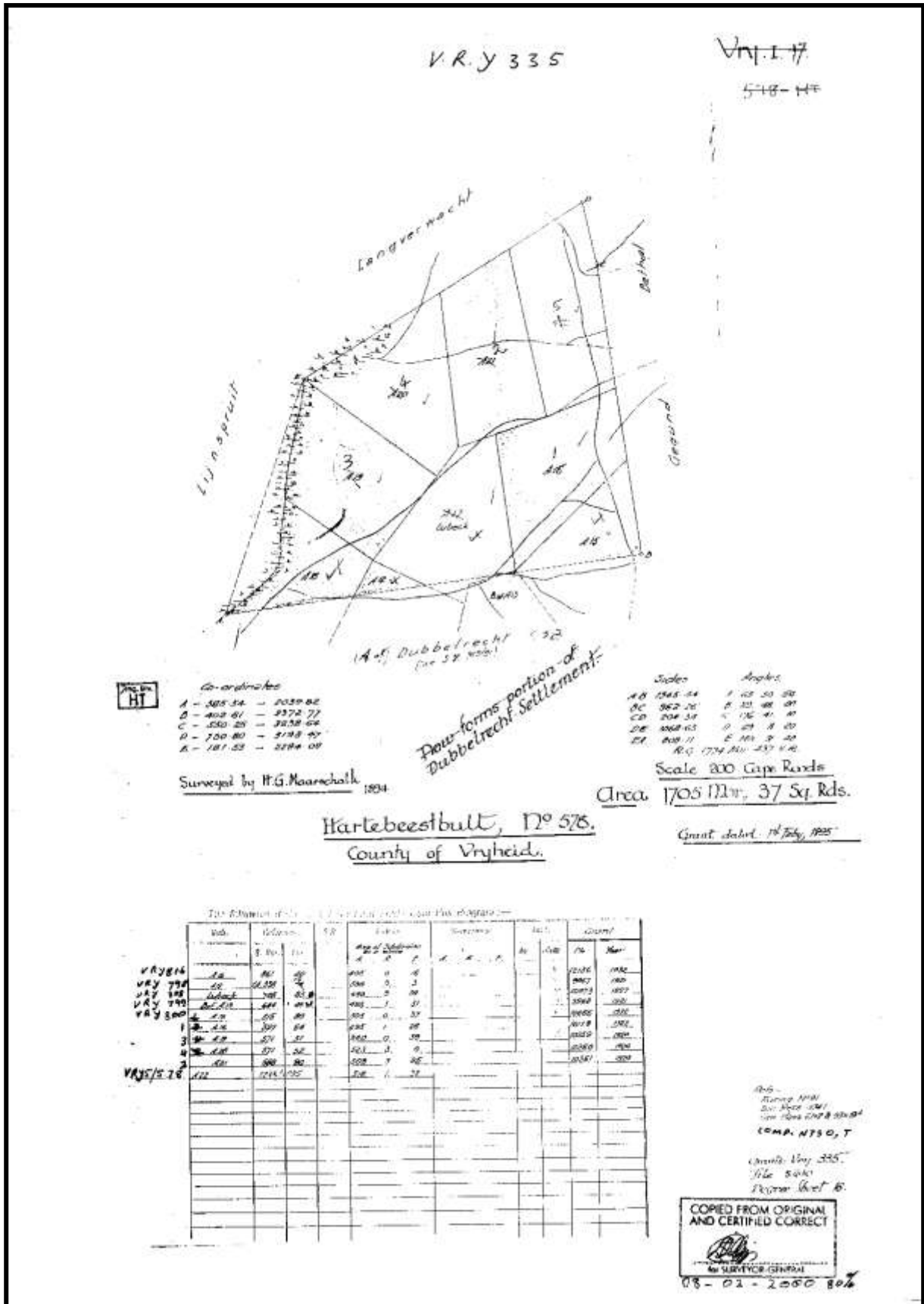
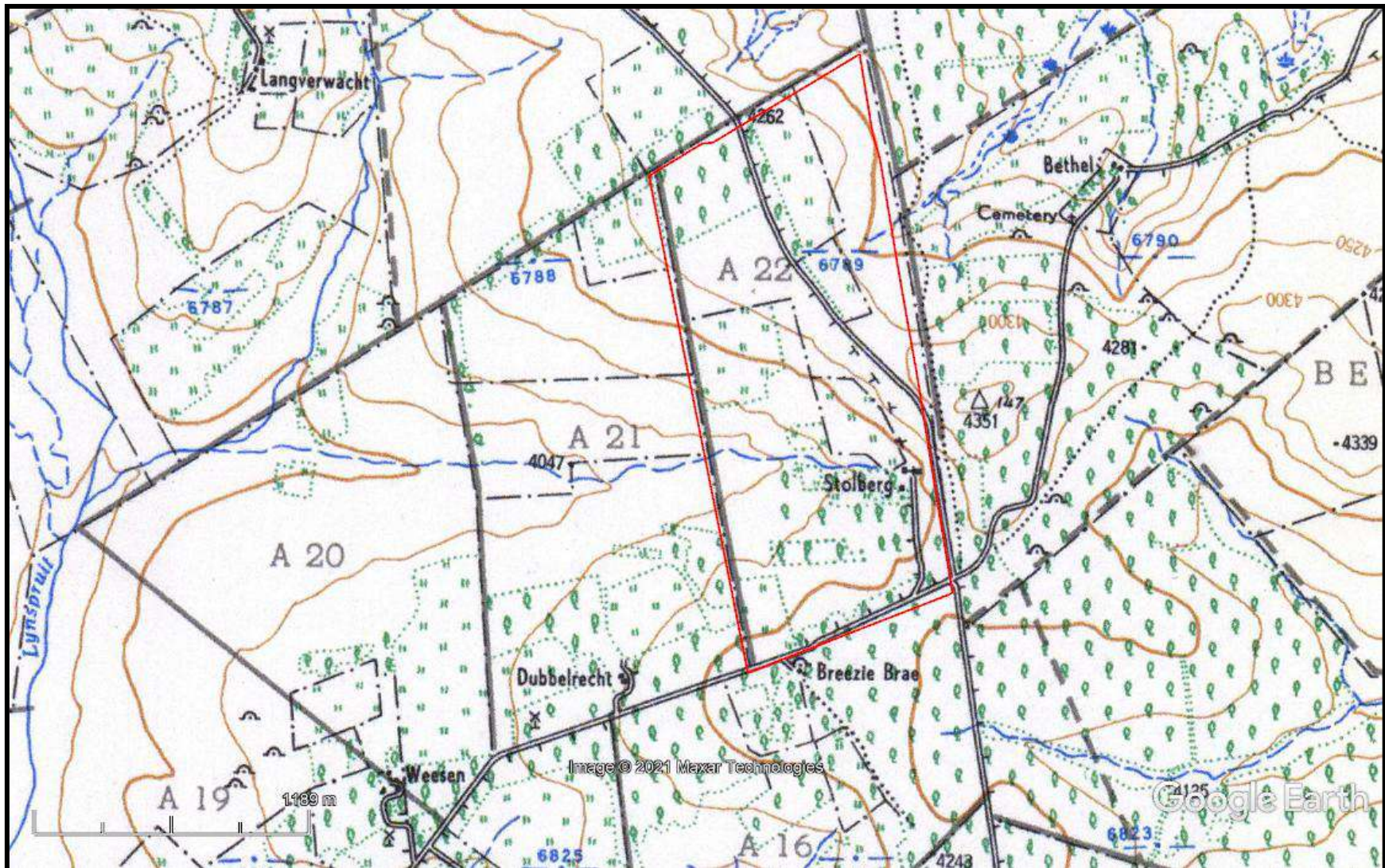


FIG. 7: LOCATION OF THE STUDY AREA IN 1952

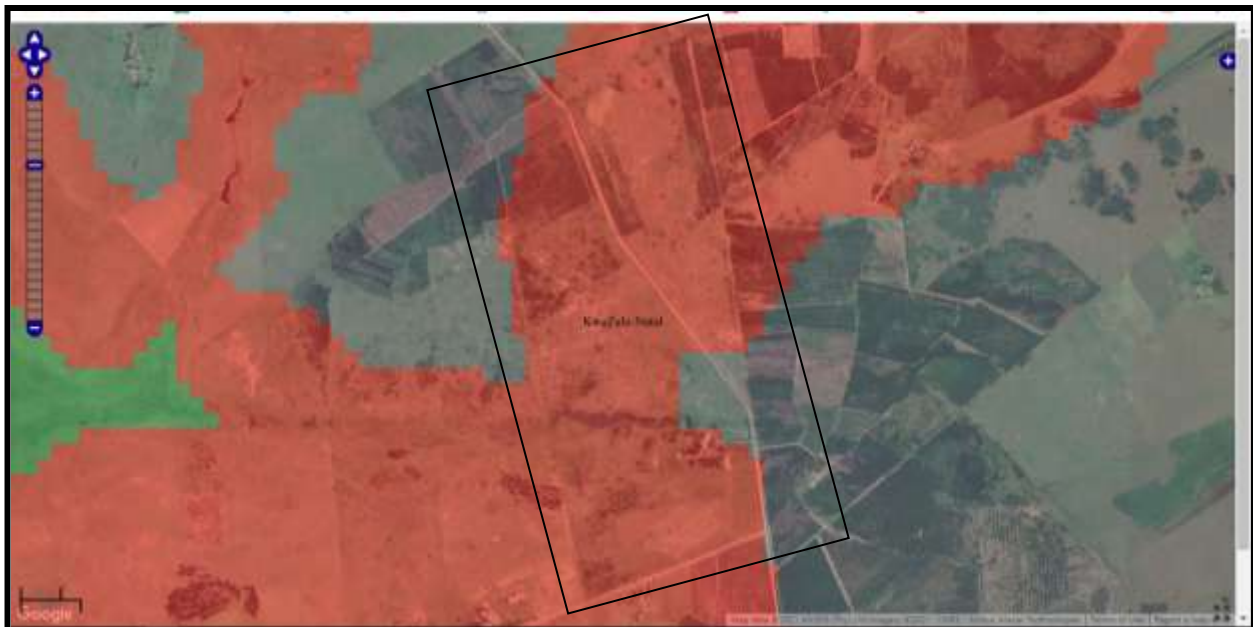


PALAEONTOLOGICAL SENSITIVITY

The area is mostly in an area of very high palaeontological sensitivity (fig. 8). Dr A Smith was requested to undertake a desktop PIA study (Appendix A). He states that “No vertebrate fossils have been recorded from the Vryheid Formation in this area, however invertebrate trace fossils, such as trace fossils, are common (Tavener Smith, 1983; Mason and Christie, 1985; Hastie et al., 2019). Trace fossils are not palaeontologically important, they can be used to identify palaeoenvironments but are very common.”

The chances of finding vertebrate fossils in this specific area is very low, and thus no further mitigation is required.

FIG. 8: PALAEONTOLOGICAL SENSITIVITY MAP



COLOUR	SENSITIVITY	REQUIRED ACTION
RED	VERY HIGH	field assessment and protocol for finds is required
ORANGE/YELLOW	HIGH	desktop study is required and based on the outcome of the desktop study, a field assessment is likely
GREEN	MODERATE	desktop study is required
BLUE	LOW	no palaeontological studies are required however a protocol for finds is required
GREY	INSIGNIFICANT/ZERO	no palaeontological studies are required

WHITE/CLEAR	UNKNOWN	these areas will require a minimum of a desktop study. As more information comes to light, SAHRA will continue to populate the map.
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FIELD SURVEY

The field survey was undertaken on 8 November 2021. Construction of the dam had already occurred, as well as excavations downhill from the farmhouse. In addition to this, several constructions were being undertaken around the farmhouse. A backactor was parked next to the original stone walled kraal, with its arm over the entrance and resting inside the kraal. The corner of the kraal had been recently broken. Some of the agricultural fields were already being ploughed and water pipeline had been excavated. All of this occurred prior to the heritage assessment. I have formally requested the kraal to be demarcated and declared a no-go area. KZNARI will need to comment on the structures around the farm buildings.

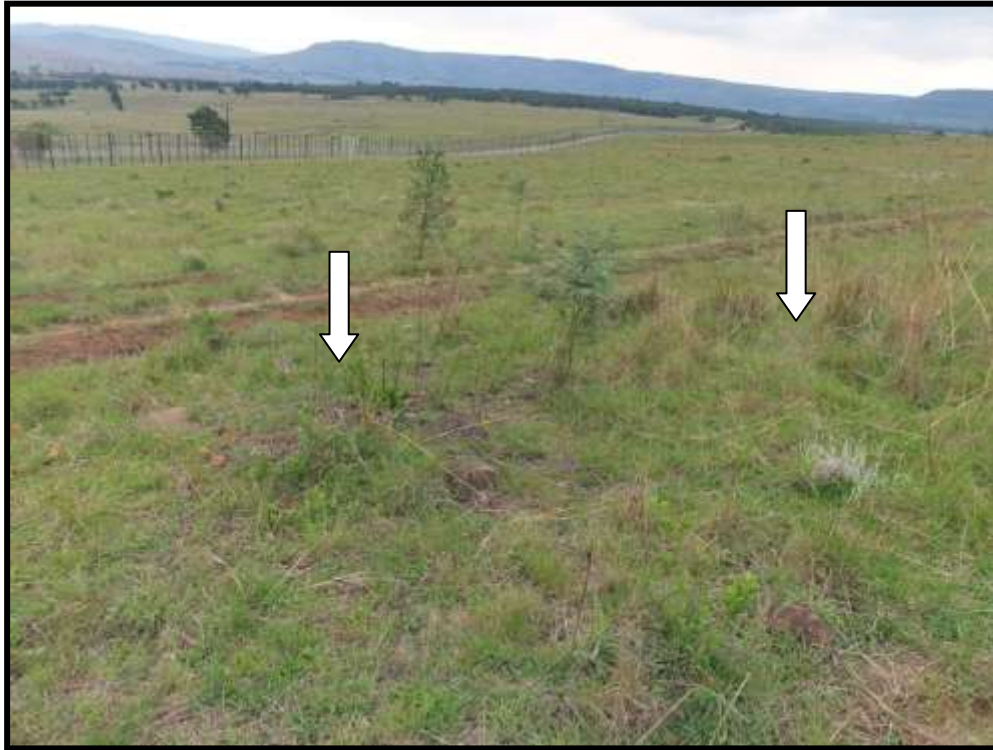
The farmhouse and associated buildings (fig. 9) predate 1952. This means that there will be historical middens on the property. These middens may be protected by heritage legislation if older than 100 years in age. I did not observe the traces of any middens around the farm complex. The current excavations did not contain any middens.

The built structure around the old abattoir area is of more recent cement/concrete bricks.

The area for the lodges occurs on the eastern side of the gravel road. There are two features in this area. The first feature is two small stone cairns that have been levelled (fig. 10). These appear to be the bases for water tanks, or similar, and have no heritage value. These are located at s27 47 0.12 e30 40 10.5.

FIG. 9: MAIN FARM BUILDINGS



FIG. 10: FLAT STONE CAIRNS

The second feature consists of two wattle and daub constructions with corrugate sheeting (fig 11). There are other smaller features around these houses. The artefacts around the structures indicate that it is more recent in age. That is, it is mainly plastic and modern artefacts on the surface. The houses do not show on the 1996 topographical map (fig. 3) and thus probably post-dates it.

Of concern is a rectangular feature in front of the houses. It is ~1m x 2m in size. The cairn is made up of building material in a well defined rectangular shape (fig. 12). The feature also continues below the surface. The feature fits the definition of a human grave. The feature should be treated as a human grave until proven otherwise. Since it is a potential grave outside of a formal cemetery, it is protected by the KZNARI Act of 2018. The grave is located at S27 47 0.12 E30 40 10.55).

Google earth imagery shows the houses occurring in February 2020 (fig. 13).

Significance: The grave is of high significance.

Mitigation: There are several options for this grave. First, a 20m buffer is placed around grave where no activity may occur. The grave is also fenced off with the fencing 5m from the edge of the grave. This is the standard policy for grave demarcation.

The second option is to locate the people who used to live here, and they sign a sworn affidavit that this feature is, or is not, a grave.

The third option is to hire undertakers who could excavate the grave. This would require a public participation process before the excavations began.

FIG. 11: HOUSE REMAINS



FIG. 12: POSSIBLE GRAVE



FIG. 13: HOUSES IN 2021



RECOMMENDATIONS

The proposed development will indirectly affect existing buildings and the general farm complex. The main buildings, including sheds and kraals are protected by heritage legislation. These may not be damaged, altered or demolished without a permit from KZNARI. The impact on the kraal is minor; however, we have not had any feedback regarding its demarcation. KZNARI must comment on the new building plans around the existing farmhouse if they deem it necessary. This might require a Built Environment assessment.

The occurrence of a settlement and a possible human grave requires further assessment. The developer has the option of both demarcating the grave and placing a 20m buffer around the grave with a 5m fence buffer. Alternatively, the developer may relocate the grave or find the original residents and obtain a sign affidavit stating if there are (not) ancestral remains on the land.

Subsequent to the initial report the development will choose to buffer the potential grave. Photographic evidence of this (with a scale) will be required.

CONCLUSION

A heritage survey was undertaken for the proposed development on the Farm Hartbeestbult 578. The farm was occupied shortly after 1895 when it was Granted. The original farm buildings would date to late 19th century to early 20th century. Construction had already started by the time of the survey with a dam being extended and some excavations undertaken. There is possible damage, albeit minor, to the stone walled kraal.

No heritage sites were note outside of the farm complex n the main development. However, farm labourer's houses were noted in the location of the proposed lodges. There is a potential human grave at this settlement, and it should be treated as a grave until [proven otherwise. This grave needs to be buffered or relocated.

The PIA desktop noted that the area would probably have trace fossils. However, these are of low significance and no further mitigation is required.

REFERENCES

2730DC eMondlo 1952, 1996
V.R.Y. 335

KZN Museum database
SAHRIS database
Umlando Database

EXPERIENCE OF THE HERITAGE CONSULTANT

Gavin Anderson has a M. Phil (in archaeology and social psychology) degree from the University of Cape Town. Gavin has been working as a professional archaeologist and heritage impact assessor since 1995. He joined the Association of Professional Archaeologists of Southern Africa in 1998 when it was formed. Gavin is rated as a Principle Investigator with expertise status in Rock Art, Stone Age and Iron Age studies. In addition to this, he was worked on both West and East Coast shell middens, Anglo-Boer War sites, and Historical Period sites.

DECLARATION OF INDEPENDENCE

I, Gavin Anderson, declare that I am an independent specialist consultant and have no financial, personal or other interest in the proposed development, nor the developers or any of their subsidiaries, apart from fair remuneration for work performed in the delivery of heritage assessment services. There are no circumstances that compromise the objectivity of my performing such work.

A handwritten signature in black ink, appearing to read 'G. Anderson', with a horizontal line underneath.

Gavin Anderson
Archaeologist/Heritage Impact Assessor

APPENDIX A
PIA DESKTOP

**PROPOSED SUSTAINABLE DEVELOPMENT OF THE
HARTEBEEBULT FARM, NEAR VRYHEID: DESK-TOP
PIA**

FOR

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29 October 2021

Declaration of Independence

This report has been compiled by Dr Alan Smith (Pr. Sc. Nat.) of Alan Smith Consulting, Durban. The views expressed in this report are entirely those of the author, if not then the source has been duly acknowledged. No other interest was displayed during the decision making process for the Project.

Specialist: Dr Alan Smith

Signature:



EXECUTIVE SUMMARY

Alan Smith Consulting was appointed to conduct a desk-top assessment of the potential impacts to **Palaeontology Resources** that might occur through the proposed Hartebeesbult Sustainable Farm, near Vryheid, KwaZulu-Natal. This project is to be constructed on Vryheid Formation and Karoo Dolerite lithologies.

Section 38 of the National Resources Act No 25 of 1999 (Heritage Resources Management), requires a Palaeontological Impact Assessment (PIA) to assess any potential impacts to palaeontological heritage.

The chances of encountering fossils is very **Low**, but **Not Zero**; consequently a “*Chance Find Protocol*” has been included.

No further palaeontological work is required at this stage.

ACRONYMS

BA:	Basic Assessment
EDTEA:	(Department of) Economic Development, Tourism and Environmental Affairs
HIA:	Heritage Impact Assessment
PIA;	Palaeontological Impact Assessment
SAHRA:	South African Heritage Resource Agency
SAHRIS:	South African Heritage Resources Information System

1. BACKGROUND

Project Name: Hartebeesbult Farm Sustainable Development (Figure 1).

Project Description: Proposed sustainable development of the Hartebeestbult farm in Vryheid. The sustainable development includes the reforming of the 220ha farm in order to expand the existing feedstock area, re-establishment of the existing Abattoir, Upgrade of roads, farm fencing, Small Lodge Development and Dams and Water reticulation Upgrade and agricultural Planting Areas for crops and citrus.

Project Locality: The site is situated approximately 10km west of Vryheid, 6km north of Scheepersnek Môl (R33 R34) and 3,7km west of the Vryheid Agricultural High School, KwaZulu-Natal Province.



Figure 1: Location map of Proposed Hartebeesbult Sustainable Farm, Vryheid.

This desk-top Palaeontological Impact Assessment forms part of a Heritage Impact Assessment (HIA) which complies with the requirements of the South African National Heritage Resource Act No 25 of 1999 (revised 2017) as well as the KwaZulu-Natal Heritage Act No 4 of 2008. In accordance with Section 38 of the National Resources Act No 25 of 1999 (Heritage Resources Management), a PIA is required to assess any potential impacts to palaeontological heritage within the development area.

2. TERMS OF REFERENCE

Alan Smith Consulting was requested by **UMLANDO: Archaeological Surveys & Heritage Management, PO Box 102532, Meerensee, KwaZulu-Natal 3901** to provide a desk-top Palaeontological Impact Assessment to assess the likelihood of encountering

palaeontological material on the Hartebeesbult site. The work was to be based on the knowledge gained from a desktop literature review, maps and personal experience (see Section 10 of this report). This report is to meet the requirements of the National Environmental Management Act (Act 107 of 1998) [as amended] Environmental Impact Assessment (EIA) regulations, Appendix 6.

3. SCOPE AND PURPOSE OF REPORT

A Palaeontological Impact Assessment (PIA) is a means of identifying any significant palaeontological material on a given site. Surface palaeontological discoveries are rare, consequently foundation excavations are the best method of uncovering new fossils. Obviously this must be well-monitored.

This desk-top investigation fulfills the requirements of the heritage authorities (SAHRA), such that a comment can be issued by them for consideration by the competent authority (EDTEA), who will review the Basic Assessment (BA) and grant or refuse authorisation. The desk-top PIA report will outline any management and/or mitigation requirements that will need to be complied with from a heritage point of view and that should be included in the conditions of authorisation, should this be granted.

4. METHODOLOGY

This report was compiled from desk-top research and personal experience to construct this report. Dr Alan Smith has detailed field knowledge of the Hartebeesbult Farm area.

5. GEOLOGY

Two lithologies, the Vryheid Formation and Karoo Dolerite are present on site (Figure 2). These two rocks are part of the Karoo Supergroup.

Vryheid Formation

The Permian aged Vryheid Formation (Kungurian Stage \approx 260Ma: Green and Smith, 2012) comprises predominantly coarse-grained sandstone and siltstones, interbedded with dark shales and coal beds. The Vryheid Formation is interpreted as wave-dominated deltaic (Green and Smith, 2012). This was deposited within the margins of the ancient Karoo Sea, located within the margins of the ancient supercontinent of Gondwana (Johnson et al, 2009). Economic coal seams are known from the Vryheid Formation in this region (Tavener Smith, 1982; Hastie et al., 2019).

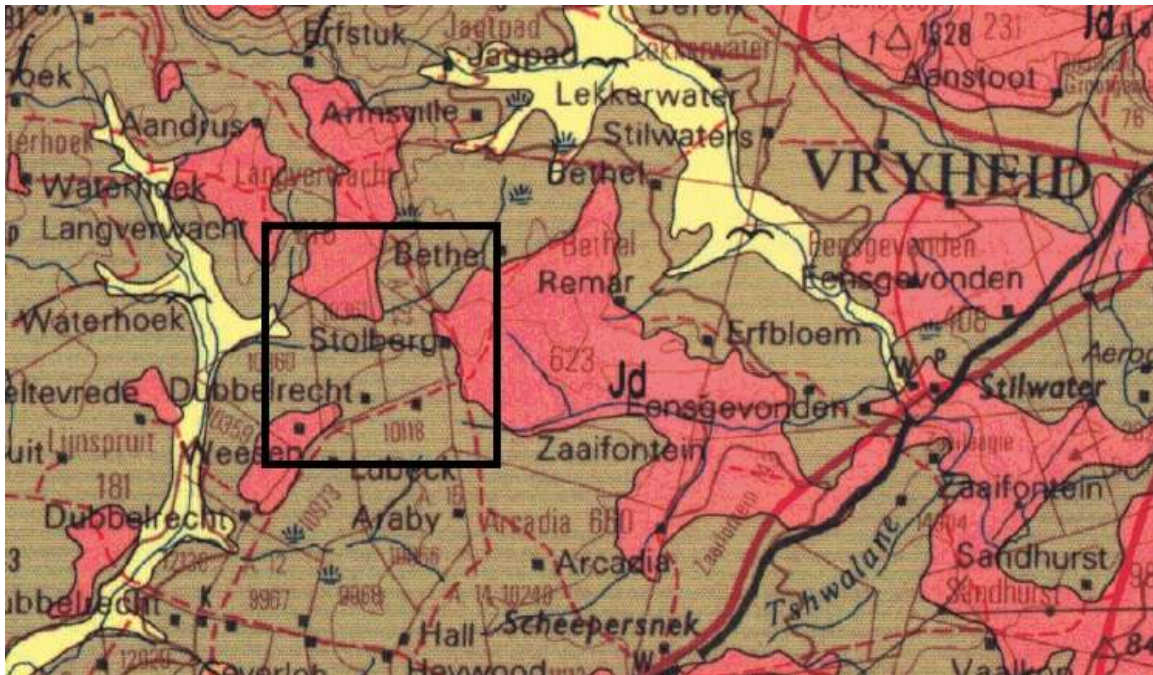


Figure 2: Extract from the Vryheid 2730 1:250 000 Geological map. The approximate area is boxed. Only Vryheid Formation (Brown) and a Karoo dolerite (Jd) rocks are present.

Exposures of Vryheid Formation in this area represent sediments deposited within shallow marine and terrestrial environments (Figure 3). The shallow marine deposits represent wave-dominated deltaic deposits (Green and Smith, 2012) The terrestrial sediments comprise fluvial, deposited by rivers, and coal, mainly deposited on floodplains, (Hastie et al., 2019). Economically exploited coal seams are known from this

region, which is referred to as the Vryheid Coal Measures (Tavener-Smith, 1983; Hastie et al., 2019).

Karoo Dolerite

The Karoo Dolerite is represented by dykes (Figure 3) and sills, within this area. It is part of the Karoo Large Igneous Province (LIP). The Karoo LIP was a sequence of lavas up to 4.5 km thick which was deposited about 184 Ma (million years ago). This igneous deposit was extruded as a flood basalt. This process takes place by fissure eruption. This LIP event triggered the break-up of the Gondwana Supercontinent. Dolerite dykes may have been the conduits whereby the igneous rock was conveyed to the surface and erupt as lava (Hastie et al., 2014).



Figure 3: Example of what a dolerite dyke (very weathered) intruding the Vryheid Formation looks like.

6. PALAEOLOGY

Vryheid Formation

The SAHRIS Palaeosensitivity Map (Figure 4) considers the Vryheid Formation as a **Very High Palaeosensitivity Zone** (Table 1). In practise there is a wide variation of Vryheid Formation lithologies. No vertebrate fossils have been recorded from the Vryheid Formation in this area, however invertebrate trace fossils, such as trace fossils,

are common (Tavener Smith, 1983; Mason and Christie, 1985; Hastie et al., 2019). Trace fossils are not palaeontologically important, they can be used to identify palaeoenvironments but are very common. Groenewald (2018) pointed out that the aquatic reptile, *Mesosaurus* (earliest known reptile from the Karoo Basin), as well as the fish, *Palaeoniscus capensis*, have been recorded in the Whitehill Formation in the southern part of the Karoo Basin (MacRae, 1999). The Whitehill Formation, within the Main Karoo Basin, *may* be a correlative of the Vryheid Formation however it is 500 km to the southwest and not connected to the Vryheid Formation. Thus this correlation remains unproved.

Coal comprises compressed plant material and thus constitutes a fossil bed. Plants such as *glossopteris*, *gangamopteris* and *sigillaria* can be recognized, but these are common. Coal is routinely burned to fuel power stations.



Figure 4: Palaeosensitivity of the Hartbeesbult Sustainable Farm area. Red represents Vryheid Formation, Green represents alluvial deposits and Grey the Karoo Dolerite. See Table 1 for palaeosensitivity codes.

Table 1: Summary of SAHRIS categories

Colour	Sensitivity	Required Action
RED	VERY HIGH	field assessment and protocol for finds is required

ORANGE/YELLOW	HIGH	desktop study is required and based on the outcome of the desktop study, a field assessment is likely
GREEN	MODERATE	desktop study is required
BLUE	LOW	no palaeontological studies are required however a protocol for finds is required

Karoo Dolerite

This rock is igneous and by definition cannot be fossiliferous.

7. SUMMARY

The chance of significant fossils being found on this site is **Low**, but not **Zero**. A “**Chance Find Protocol**” has been included to cover this eventuality. No further formal palaeontological work is required, unless triggered by the “**Chance Find Protocol**”, which must form part of the Environmental Management Program (EMPr) for the site

8. CHANCE FIND PROTOCOL

This Chance Find Protocol must be included in the site EMPr.

If any fossils are found, a Palaeontologist must be notified immediately by the ECO and/or EAP and a site visit must be arranged at the earliest possible time with the Palaeontologist.

In the case of the ECO or the Site Manager becoming aware of suspicious looking palaeo-material:

- The construction must be halted in that specific area and the Palaeontologist must be given enough time to reach the site and remove the material before excavation continues.
- Mitigation will involve the attempt to capture all rare fossils and systematic collection of all fossils discovered. This will take place in conjunction with descriptive, diagrammatic and photographic recording of exposures, also involving sediment samples and samples of both representative and unusual sedimentary or biogenic features. The fossils and contextual samples will be processed (sorted, sub-sampled, labeled, and boxed) and documentation consolidated, to create an archive collection from the excavated sites for future researchers.

Functional responsibilities of the Developer

1. At full cost to the project, and guided by the appointed Palaeontological Specialist, ensure that a representative archive of palaeontological samples and other records is assembled to characterize the palaeontological occurrences affected by the excavation operation.
2. Provide field aid, if necessary, in the supply of materials, labour and machinery to excavate, load and transport sampled material from the excavation areas to the sorting areas, removal of overburden if necessary, and the return of discarded material to the disposal areas.
3. Facilitate systematic recording of the stratigraphic and palaeo-environmental features in exposures in the fossil-bearing excavations, by described and measured geological sections, and by providing aid in the surveying of positions where significant fossils are found.
4. Provide safe storage for fossil material found routinely during excavation operations by construction personnel. In this context, isolated fossil finds in disturbed material qualify as “normal” fossil finds.
5. Provide covered, dry storage for samples and facilities for a work area for sorting, labeling and boxing/bagging samples.
6. Costs of basic curation and storage until collected. Documentary record of palaeontological occurrences must be done.
7. The contractor will, in collaboration with the Palaeontologist, make the excavation plan available to the appointed specialist, in which appropriate information regarding plans for excavations and work schedules must be indicated on the plan of the excavation sites. This must be done in conjunction with the appointed specialist.
8. Initially, all known specific palaeontological information will be indicated on the plan. This will be updated throughout the excavation period.
9. Locations of samples and measured sections are to be pegged, and routinely and accurately surveyed. Sample locations, measured sections, etc., must be recorded three-dimensionally if any “significant fossils” are recorded during the time of excavation.

9. REFERENCES

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10. DETAILS OF SPECIALIST

Dr Alan Smith

Private Consultant: *Alan Smith Consulting, 29 Brown's Grove, Sherwood, Durban, 4091*

&

Honorary Research Fellow: *Discipline of Geology, School of Agriculture, Earth and Environmental Sciences, University of KwaZulu-Natal, Durban.*

Role: Specialist Palaeontological Report production

Expertise of the specialist:

- PhD in Geology (University of KwaZulu-Natal), Pr. Sc. Nat., I.A.H.S.
- Expert in Vryheid Formation (Ecca Group) in northern KZN, this having been the subject of PhD.
- Scientific Research experience includes: Fluvial geomorphology, palaeoflood hydrology, Cretaceous deposits.
- Experience includes understanding Earth Surface Processes in both fluvial and coastal environments (modern & ancient).
- Alan has published in both national and international, peer-reviewed journals. He has published + 50 journal articles with 497 citations (detailed CV available on request).
- Attended and presented scientific papers and posters at numerous international and local conferences (UK, Canada, South Africa) and is actively involved in research.

Selected recent palaeo-related work includes:

- Desktop PIA: Proposed middle income housing units on Portion 23 of Farm Lot H Weston 13026, Bruntville, Mpofana Local Municipality. Client: UMLANDO.
- Desktop PIA: Proposed ByPass Pipeline for Ulundi bulk water pipeline upgrade. Client: UMLANDO.
- Fieldwork PIA: Bhekuzulu Epangweni KZN water reticulation project, Cathkin Park. Client: Mike Webster, HSG Attorneys.
- Fieldwork PIA: Mpungoze water supply scheme, Empangeni. Client: Enviropro.
- Fieldwork PIA: Helpmekaar Dam. Client: Afzelia environmental consultants.
- Desktop PIA: Zuka valley, Ballito. Client: Mike Webster, HSG Attorneys.
- Mevamhlope proposed quarry palaeontology report. Client: Enviropro.
- Desktop PIA: Proposed Lovu Desalination site. Client: eThembeni Cultural Heritage.

- Desktop PIA: Tinley Manor phase 2 North & South banks: eThembeni Cultural Heritage
- Desktop PIA: Tongaat. Client: eThembeni Cultural Heritage.
- Palaeontological Assessment Reports (3) to Scatec Solar SA (Pty) Ltd on an Appraisal of Inferred Palaeontological Sensitivity for a Potential Photo Voltaic Park at (1) Farm Rooilyf near Groblershoop, N Cape; (2) Farm Riet Fountain No. Portions 1 and 6, 18km SE of De Aar, N Cape; and (3) Dreunberg, near Burgersdorp, Eastern Cape. Client: Sustainable Development Projects.